

tions of these three prototypes on the market. The broad area contact is preferred for patients with osteoporosis and thus is used in many with rheumatoid arthritis. The narrow track type (polycentric) is used for those who have osteoarthritis and little or no osteoporosis. The hinge type is used for those patients whose knees are totally unstable; they seem to have a special place when there is severe posterior subluxation of the tibia. Infection and, therefore, a failure rate of at least 25 percent is expected when hinge knee joints are used.

#### *Metacarpophalangeal Joints*

Swanson and Niebauer working independently devised flexible silicone rubber prosthetic devices to be used in these joints. Both have proved satisfactory over the short term, but have yet to be proved in long-term results. The resection arthroplasty first described by Fowler and modified by Vainio and Tupper is still preferred by many experienced surgeons.

#### *Silicone Implants*

Silicone rubber implants which are used to replace carpal bones, the distal ulna, the radial head and the base of the proximal phalanx of the great toe after some bunion operations must still be considered experimental.

#### *Investigative Procedures*

There are investigations currently being made at several centers in the United States and abroad in an attempt to find suitable units to replace the shoulder, elbow and ankle joints. It is likely that suitable units for these joints will be forthcoming within the next few years. New materials for implants, such as ceramics and new alloys, are also being tested in a number of laboratories.

It is encouraging that interaction between engineering and medicine is providing the basis for new hope for disabled patients with arthritis who may require total joint replacement.

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#### REFERENCES

- Charnley J (Ed): Symposium on total hip replacement. Clin Orthop 72:2-204, Sep-Oct 1970
- Wilde AH, Collins HR, Evarts CM, et al: Geometric knee replacement arthroplasty—Indications for operation and preliminary experience. Orthop Clin North Am 4:547-559, Apr 1973
- Bryan RS, Peterson LFA: Polycentric total knee arthroplasty. Orthop Clin North Am 4:575-584, Apr 1973
- Millender LH, Nalebuff EA: Metacarpophalangeal joint arthroplasty utilizing the silicone rubber prosthesis. Orthop Clin North Am 4:349-371, Apr 1973

## **Spondylolisthesis**

SPONDYLOLISTHESIS refers to forward slip of a vertebra onto the one below. We usually think of a defect in the vertebral isthmus (pars interarticularis) which permits the forward slip, but there are several other types of the disease. There is degenerative spondylolisthesis, which frequently occurs in elderly females. Most commonly the fourth lumbar vertebra slips forward on the fifth lumbar vertebra because of degenerative disease, without pars defects. There is also congenital spondylolisthesis which is due to congenitally inadequate bony support. Rarely seen is penduncular spondylolisthesis where there is a defect in the pedicle which permits olisthesis to occur. Isthmic spondylolisthesis is by far the most clinically important in patients under 50 years old. It is never congenital and is never present at birth. The defect is nearly always due to a fatigue fracture with rare cases of acute fracture of the pars due to severe trauma.

#### *Types of Pars Defects*

• **TYPE A—Lytic.** This is the common type below age 50. It is due to a fatigue fracture but with a strong hereditary element. These lesions are usually present by age seven but do occur up to adulthood, especially in young male athletes.

• **TYPE B—Elongation of the pars without separation.** This type often shows a high degree of slip. It is due to repeated line fractures followed by healing, permitting slight elongation each time.

• **TYPE C—Aquisita.** This is due to a fatigue fracture in the pars at the top of a posterior spinal fusion. It is very rare now that lateral fusions are being done.

• **TYPE D—Pathological.** Defects occur in the pars in cases of generalized bone disease such as Albers-Schoenberg disease or osteogenesis imperfecta.

• **TYPE E—Acute fracture of the pars.** These are quite rare and occur after major trauma. They will heal if immobilized. It is often difficult to differentiate the acute fracture from a fatigue fracture secondary to repeated trauma such as occurs in the adolescent football player.

About half the cases with pars defects will show forward slip (spondylolisthesis) and the other half will show defects but no slip (spondylolysis).

#### *Treatment*

**TYPE A—Lytic.** In children, if it is believed that the condition has been present for a consider-

able time, one normally treats it conservatively. However, if pain persists, fusion should be done, preferably through the paraspinal approach.

Another reason for fusing in the young child is increasing slip. A slip of 25 percent will just begin to show the typical spondylolisthesis build, a 50 percent slip will produce a cosmetically undesirable stature. With a good solid fusion the tight hamstrings will disappear in several months.

Removal of the loose element alone without fusion should never be done in children.

In adults, the vast majority with spondylolisthesis can be treated conservatively. There is an occasional patient who is brought to surgery because of persistent pain. One need never operate on an adult because of fear of increased slip. In the patient past 60 years old whose principal problem is sciatica, removal of the loose element alone without fusion offers a good chance for relief of pain. Younger people should have a one-level fifth lumbar, first sacral fusion, unless the fourth lumbar level is producing symptoms.

**TYPE B—Elongation of the pars without separation.** This type is treated the same as type A. Children with this condition are a little more likely to have neurological deficit. Usually only one side is involved in the neurological deficit and need be decompressed by nerve root decompression.

**TYPE C—Aquisita.** Extension of the fusion is only rarely necessary since most of the time patients with this condition can live with the lesion.

**TYPE D—Pathological.** No surgical treatment is necessary unless there is slip, in which case the treatment is the same as described for type A.

**TYPE E—Acute fractures.** These will usually heal if immobilized in a knee-to-nipple cast for about two months. To be sure that the case is acute, the defect must have the appearance of an acute fracture, and one of two things must be present: an x-ray film taken beforehand showing an intact pars, or healing of the pars with immobilization.

#### *Degenerative Spondylolisthesis*

The patient should be treated conservatively as long as possible and then decompression is indicated. Often it is not possible to decompress adequately without removing a large portion of the facets. Progression of slip will often occur in these cases. I have seen one case with 33 percent slip before surgery increase to 50 percent after surgery. Fusion should definitely not be done in

these older patients. For the occasional patient in his early 50's, a one-segment intertransverse fusion should be done after thorough decompression.

#### *Congenital Spondylolisthesis*

The treatment of congenital spondylolisthesis is very similar to that of isthmic spondylolisthesis types A and B. There is forward slip with an intact pars, usually due to insufficiency of the superior sacral facets.

Progressive slip is an indication for fusion. These children are much younger than children with the other types, often as young as 5 or 6 years old. A one-level fusion done through the paraspinal approach will stop further slip.

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#### REFERENCES

- Rosenberg N: Degenerative spondylolisthesis. Paper presented at the American Orthopedic Association, Hot Springs, Virginia, Jun 26, 1973
- Wiltse LL, Widell EH Jr: Stress fracture—The basic lesion in spondylolisthesis. Paper presented at the American Academy of Orthopaedic Surgeons, Las Vegas, Nevada, Feb 2, 1973
- Wiltse LL: The paraspinal sacrospinalis-splitting approach to the lumbar spine. Clin Orthop 91:48-57, Mar-Apr 1973

### **The Critical Osseotendinous Junction**

IN ATHLETICS in particular, and in certain physical fitness programs in general, the recent emphasis on recreational health, intensive conditioning programs, lengthened seasons for various sports, high level competition and extended athletic careers has increased tendon vulnerability, especially at the osseotendinous junction. Contrary to previous impressions, the area of origin or insertion of a tendon into bone may be involved to a lesser or greater extent. This results in a wide range of conditions: (1) discomfort after activity and no functional disability (phase 1), (2) discomfort during and after activity and no functional disability (phase 2), (3) discomfort during and after activity and significant functional disability (phase 3) and (4) discomfort all the time with significant functional disability or complete tendon rupture (phase 4). These various stages in the development of "tendinitis" have been seen in the swimmer's shoulder, tennis elbow, jumper's knee and achilles tendinitis.

Our incomplete understanding of the underlying pathology and our inability to effectively reverse this process with existing physical therapy modalities or anti-inflammatory medication or both represent basic defects in our approach to these